

REQUEST FOR INFORMATION
KSC ENVIRONMENTAL CONTROL SYSTEM,
ORION PORTABLE PURGE UNIT (OPPU)

1. Introduction & Background

1.1. Purpose & Scope

The Kennedy Space Center, in support of NASA's Constellation Program, is conducting an assessment of key technologies for the next generation of portable purge equipment for Orion Spacecraft. The portable purge equipment will be used to purge the Orion Spacecraft during prelaunch processing at the Kennedy Space Center (KSC) after retirement of the current Space Shuttle portable purge equipment fleet. The Orion Portable Purge Unit (OPPU) subsystem is the subject of this Request for Information (RFI).

1.2. RFI Objectives

The principal objective of this Request for Information (RFI) is to solicit cost estimates for the development of a new portable purge system.

The goals for this RFI is to:

- Gather information on commercial off-the-shelf (COTS) solutions and to assess their potential for satisfying purge requirements. This evaluation will attempt to characterize the cost/benefit tradeoffs associated with using COTS solutions versus re-use of existing capabilities and determine the most cost effective approach over the life cycle of the Constellation Program.
- Gather information on significant advances that have been made in HVAC technologies in recent years. Before NASA embarks on the development or acquisition of a new OPPU system, it needs to be aware of current capabilities and best practices.
- Gather information on the total cost of ownership for the OPPU subsystem assuming a 20-year program life cycle. This includes the costs of initial acquisition, development, training of personnel, operations, maintenance, sustaining engineering, and periodic technology refresh. Life-cycle cost estimates may be 'order-of-magnitude' only, as accurate as can be estimated, but not formal quotations.
- Inquire the market for companies that have done work in Environmental Control Systems or related systems design particularly regarding scale, technology sophistication and, if applicable, systems that you have developed for other customers. In addition, this RFI searching for industry capabilities for testing Environmental Control Systems in different Natural Environments like rain, fog, vibration, temperature, humidity, etc.

1.3. Orion Portable Purge Unit (OPPU) description

The Orion Portable Purge Unit (OPPU) shall be a tow-around, electrically powered, refrigerant vapor cycle, computer controlled, self contained air processing unit. The unit utilizes the latest state-of-the-art technology to provide a dehumidified, filtered, metered, and temperature-controlled air purge for the Orion spacecraft through two separate duct systems. The OPPU shall be design to utilize commercially available components to deliver a continuous, measured, filtered, dehumidified and

temperature-controlled air flow to the Orion Service Module/Spacecraft Adapter (SM/SA) and Command Module/Soft Cover (CM/SC). A portable 350 KW generator shall furnish operational electrical power. The system shall be capable of providing the following basic functions:

- a) Heating
- b) Cooling
- c) Dehumidification
- d) Reheat

The conditioning process begins with the centrifugal blower drawing 185 lbs./min. of ambient air through the inlet filter chamber and compressing it to 110" H2O (4 psig). The air then enters the main plenum and passes across the rejection heat pipe, where 45 deg. F of the heat of compression is transferred to the atmosphere. The air then passes across the precool side of a wrap around heat pipe, where an additional 10 deg. F of heat is removed before passing through the dehumidifying coil. Passing through this coil at 2.5 psig, the air is cooled to a maximum 41 deg. F dew point temperature and a humidity ratio of 37 grains of moisture per pound of dry air. The air then passes through the reheat side of the wrap around heat pipe, where the 10 deg. F of heat previously removed by the precool side is now returned to the processed air. Next the air moves through the activated carbon filters where hydrocarbons are removed below 44 ppm, and the High Efficiency Particulate Air (HEPA) filters where contaminating particulates are removed below ISO 14644-1 Class 8 level. Excess air that was used to maintain the pressure in the main plenum, but is not needed to satisfy the required total flow rate, is discarded through a dump valve to maintain a constant load on the blower and prevent blower surging. The cool clean air then moves into the 2 individual heater banks where it is reheated to the required temperatures, then discharged into individual transitions and accurately metered to the proper low rate for each duct. The major components of this purge unit are: inlet filters, blower, rejection heat pipe, wrap around heat pipe, R-417A direct expansion refrigeration system, carbon filters, HEPA filters, main plenum, Electrical heaters, instrumentation, flow control system and a programmable logic controller (PLC). The unit shall be designed to withstand the highly corrosive conditions of the atmosphere normally found within two miles of the Atlantic Ocean coastline at Kennedy Space Center, Florida.

The unit shall be capable of delivering a continuous airflow simultaneously through two separately controlled duct outlets or any one outlet. The unit shall use 100% outside air at design ambient conditions.

<i>Duct</i>	<i>Flow Rate (lbs/min)</i>	<i>Temp (dry/F)</i>	<i>Maximum Humidity GR/LB</i>	<i>Clean (ISOclass)</i>	<i>Maximum Hydrocarbon (PPM)</i>
CM/SC	0-85	57-87	37	Class 8	44
SM/SA	0-100	57-87	37	Class 8	44

In addition to the maximum humidity requirement of 37 grains of moisture per pound of dry air, the cooling-coil temperature shall not exceed 37 degrees Fahrenheit at 3

psig operating pressure. The coils shall be designed to minimize moisture carry-over. To account for heat gain from the OPPU to the vehicle interface, the OPPU shall deliver air at no more than 40 degrees at the OPPU output when any circuit requires a minimum temperature purge. Heaters shall be sized to provide air at the OPPU interface up to 10 degrees above the maximum circuit temperature listed in this paragraph. The maximum total simultaneous flow rate delivered by the OPPU shall be no less than 185 lbs./min. and sufficient to meet the following at maximum vehicle interface pressures:

CM/SC	85 lbs./min. @ 1.5 psig
SM/SA	100 lbs./min. @ 1.5 psig

The unit shall be assembled on a metal platform within a rigid metal enclosure and suitably mounted on skids. The enclosure of the OPPU shall be designed for operation in heavy rains without collecting water and for easy access for outdoor service. It shall be a rigid structure with deep louvered panels and doors for ventilation. The instrumentation shall be enclosed in weather tight enclosure with doors for access to the controls. The enclosures shall be designed for outdoor service. The enclosure material shall be aluminum. All working parts shall be accessible through convenient doors and removable panels or louvers. Adequate sealing of doors and panels shall be used to protect critical components from rain and pressurized water spray.

The maximum overall dimensions including protrusions of the unit on the KAMAG Transporter shall be:

- a. height, 8 feet 2 inches plus protruding duct
- b. length, 20 feet 0 inches
- c. width, 9 feet 4 inches

Gross weight of unit shall not exceed 15,000 pounds and shall maintain the footprint dimensions for mounting on the deck of one KAMAG Transporter. Unit shall be designed and built to withstand the loads, shocks, and resulting stresses of transportation by way of land, air, or rail. Unit shall have capability of being lifted and transported by forklift truck and a crane. Enclosure shall be weatherproof and corrosion resistant for outdoor service in the highly corrosive conditions of the atmosphere normally found within two miles of the Atlantic Ocean coastline at Kennedy Space Center, Florida. The unit shall be designed with the ability to sustain a single component failure without causing injury, loss of life or damage to the Orion spacecraft or its contents.

2. Instructions for Responding to this RFI

2.1. Issues to be Addressed

In order to meet the objectives of this RFI certain key issues need to be explicitly addressed. These include, but are not limited to:

2.1.1 Major Technology Drivers & Design Philosophy

NASA is interested in learning what technologies, both new and established, would be most applicable and what overall design philosophy would be most effective given the long potential life cycle of the system. Describe both the recent technology advances and the mature technologies that you would recommend be integrated in a new OPPU design and the design philosophy which facilitates integration of new advances as they become available in the future.

2.1.2 Customer Application Examples

Please describe your prior work in Environmental Control systems or related system design particularly regarding scale, technology sophistication and, if applicable, systems that you have developed for other customers.

2.2. Who May respond

Any organization experienced in storage, recording, retrieval, data acquisition, command and control, or telemetry technologies may respond to this RFI. This solicitation for information will be posted on the Federal acquisition web site FedBizOpps. Selected storage industry companies, telemetry companies, and key launch services providers will be specifically invited to respond. The Federal acquisition web site is at <http://www.fedbizopps.gov/>.

2.3. How to respond

A written response to this RFI should be provided to the responsible KSC Contracting Officer by the date indicated below. Responses may be provided via mail or email or both. Responses in electronic format (e.g. PDF, Word, PowerPoint, etc.) are preferred.

2.4. Partial Response

Organizations that are not able to provide a comprehensive response to all areas of this RFI, but which may have information about one or more key technologies that should be considered in an overall solution, are encouraged to provide a partial response which may only address selected topics relevant to this RFI.

2.5. Schedule

2.5.1 Intent to Respond

Organizations that intend to provide a written response to this RFI are requested to notify the KSC Contracting Officer not later than April 10th, 2009. However, a failure to provide such notification does not disqualify any organization and all interested parties are invited to submit a response by the response date indicated below.

2.5.2 Response Date

Responses to this RFI should be submitted to the KSC Contracting Officer not later than April 10 at 3:00P.M. est.

2.6 RFI Response Contact

The KSC Contracting Officer who will serve as the primary point-of-contact for responses to this RFI is as follows:

Rogelio Curiel

NASA OP-MS

Kennedy Space Center, FL 32899

321 867-7498 (Office)

321 867-2825 (Fax)

Rogelio.Curiel-1@nasa.gov

2.7 Distribution of RFI Responses

Distribution of responses to this RFI will be exclusively within NASA and its Contractor support on the Constellation Program. No public distribution of the responses will be made. All information obtained through this RFI will be used internally as part of NASA's evaluation of key technologies in support of development of the OPPU.

2.8 Reimbursement

This document is for information and planning purposes only. It is not to be construed as a commitment by the Government nor will the Government pay for the information submitted in response. Respondents will not be notified of the results of this evaluation.

2.9 Questions Regarding this RFI

All questions regarding this RFI should be directed to the KSC Contracting Officer identified above.

2.10 Review Process

Once all responses to this RFI have been received, NASA will conduct an evaluation of the responses over the course of approximately 30 days. Recommendations reflecting the results of the evaluation will be provided exclusively to Environmental Control System designers at KSC. These recommendations will remain internal to NASA and its Constellation support contractors.

3. Information Requested

3.1 Physical Characteristics

Estimate the physical characteristics of the hardware required to implement the proposed architecture in terms of equipment size, weight, floor space requirements, power and cooling requirements.

3.2 Description

Summarize the OPPU proposed, its general specifications, the overall system design, and the features, functions, and rationale that drives their selection.

3.3 Initial Acquisition Cost

Summarize the OPPU proposed, their general specifications, the overall system design, and the features, functions, and rationale that drives their selection. Initial acquisition cost estimates may be 'order-of-magnitude' only, as accurate as can be estimated, but not formal quotations.

3.4 Life Cycle Costs

A fundamental requirement for the Constellation Program and all of its elements is to reduce the cost of access to space by minimizing the cost of acquisition and operation of supporting systems. To that end, information is requested on the total cost of ownership for the OPPU subsystem assuming a 20-year program life cycle. This includes the costs of initial acquisition, development, training of personnel, operations, maintenance, sustaining engineering, and periodic technology refresh. Cost shall include the testing, packaging, handling and transportation of the unit to Kennedy Space Center, Florida. Life-cycle cost estimates may be 'order-of-magnitude' only, as accurate as can be estimated, but not formal quotations.

3.5 Design, development, testing and delivery schedules

Provide schedule for initial acquisition, development, testing, training of personnel, operations, maintenance and periodic technology refresh. Describe lead times required for fabrication and testing the unit(s). Schedule shall include the packaging, handling and transportation of the unit to Kennedy Space Center, Florida. Schedules may be as accurate as can be estimated.

3.6 General information

Provide organization name, address, describe principle activity, fabrication facilities, primary point of contact and business size. Also, provide company's capabilities for testing Environmental Control Systems in different Natural Environments like rain, fog, vibration, temperature, humidity, etc.

3.7 Experience

Describe your experience in developing and producing Environmental Control Systems for human rated spacecraft vehicles or related systems design particularly regarding scale, technology sophistication and, if applicable, systems that you have developed for other customers.